

## Food Shopping Practices Are Associated with Dietary Quality in Low-Income Households

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**ABSTRACT** Nutrition education for low-income audiences often focuses on building skills in food shopping and food resource management to help families receive the best nutrition from the resources they have available. However, empirical evidence for the effect of food shopping practice on dietary quality has been limited. This article presents new analyses from two studies that found an association between food shopping practices and diet quality. Logistic regression of data from 957 respondents from the 1996 National Food Stamp Program Survey found that food shopping practices were significantly ( $p \leq .05$ ) associated with the availability of nutrients in the food the households used during a week. Similarly, analysis of baseline data from 5159 women from selected counties of states who participated in the Expanded Food and Nutrition Education Program found that food shopping practices were significantly ( $p \leq .05$ ) associated with increased consumption of nutrients as measured through a single 24-hour recall. These findings suggest that food shopping practices are an important area for nutrition education with low-income audiences.

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### INTRODUCTION

Food shopping practices are an important aspect of food resource management. Food resource management may be described as the handling of all foods and resources that may be used to acquire foods by an individual or family. After planning, food shopping is the next link in the chain leading to food consumption, preceding the activities of food storage, preparation, and service that may further affect nutrient values.<sup>1,2</sup> Food shopping practices are often one focus of nutrition education efforts to help low-income families extend their food dollars and to help people make healthy food choices.<sup>3</sup> Accordingly, valid and reliable measures of food shopping practices could help in evaluation of nutrition education programs. However, empirical data for the relationship between food shopping practices and diet quality have been limited. Indeed, several researchers have questioned whether we adequately understand the types of food shopping practices that are useful for low-income families given the constraints that they face.<sup>2,4,5</sup>

Low-income families frequently confront constraints—such as a lack of nearby supermarkets, limited selection in nearby stores, lack of transportation to stores of their choice, lack of child care, and limited time to do food shopping—that can make food shopping skills particularly important.<sup>2,4–7</sup> A 1995 U.S. Department of Agriculture (USDA) study, which analyzed the type and geographic distribution of all 200,000 Food Stamp Program (FSP) authorized food retailers, found that about 40% of the rural population resided in localities without a supermarket or large grocery store.<sup>8\*</sup> In

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\*Classifications were made based on gross sales; supermarkets had gross sales over \$2 million, and large grocery stores had gross sales of \$500,000 to \$2 million.

urban areas, the average number of supermarkets in high-poverty areas (0.9 supermarkets) was somewhat less than in low-poverty urban areas (1.14 supermarkets).<sup>9</sup> Moreover, the supermarkets in high-poverty urban areas tended to offer fewer full-service departments, less brand choice (5%–10% less variety in brands and in package types), and less choice of fresh fruits and vegetables.<sup>9,10</sup> A USDA survey of food items and prices in a sample of 2400 stores in 1995 found that supermarkets offered a wider variety of foods at considerably lower costs than other types of stores: compared to supermarkets, the average market basket costs 33% more in small grocery stores and 50% more in convenience stores.<sup>9</sup> The higher costs in neighborhood and convenience stores were much more pronounced for high-margin items such as candy and soft drinks than for basic commodities such as milk, eggs, and potatoes. Thus, shoppers who use smaller neighborhood grocery stores may need to be especially alert to the costs of nonstaple items.

Nutrition education efforts need to recognize the pressures that influence food shopping practices in low-income families. For instance, Morton and Guthrie's analysis of 1879 women (including 658 women with children) in the 1994 Continuing Survey of Food Intakes by Individuals (CSFII) assessed women's perception of factors that influenced food purchasing decisions.<sup>5</sup> In making food purchasing decisions, lower-income (<130% of poverty) women with children were significantly more likely than higher-income women with children to rate as important how well the food keeps (75% vs. 53%,  $p \leq .05$ ), the price of food (71% vs. 36%,  $p \leq .01$ ), and the ease of preparation (42% vs. 32%,  $p \leq .05$ ).<sup>5</sup> Lower-income women with children were significantly less likely to use the nutrition label when buying food than higher-income women with children (61% vs. 68%,  $p \leq .05$ ). The authors concluded that nutrition messages must be realistic about the limited means and competing concerns of low-income consumers when attempting to improve their shopping practices.

These issues could affect the types of shopping practices low-income families are able to employ. Dinkins's<sup>4</sup> analysis of the 1993 Marketing Research Corporation of America survey of 5550 respondents compared the food shopping practices of households with a strict versus a nonstrict budget based on agreement with the item "I run my household on a strict budget." (Although the study was not restricted to low-income households, 27% of study respondents had annual household incomes of <\$20,000.) The survey found that households with strict budgets were significantly less likely than households with nonstrict budgets to make a complete list before going shopping (20% vs. 32%,  $p \leq .01$ ), shop around for food bargains (14% vs. 25%,  $p \leq .01$ ), use coupons (10% vs. 14%,  $p \leq .05$ ), or stock up when they found a sale on the brand of food items they like (5% vs. 9%,  $p \leq .05$ ). In interpreting these findings, Dinkins speculated that having a strict food budget may compel households to limit their purchases to required items so that shoppers may

perceive little need for a shopping list and may be more concerned about current cost than about long-term savings.

On the other hand, at least one study among low-income women found a relationship between food shopping practices and dietary outcomes. A study of 95 women (78 who received a 6-hour education program and 19 women in a comparison group) found that, at baseline, the frequency with which women reported using the Nutrition Facts panel on the food label to choose foods was positively associated with vitamin A ( $r = .41$ ,  $p \leq .01$ ), carotene ( $r = .43$ ,  $p \leq .01$ ), calcium ( $r = .23$ ,  $p \leq .05$ ), and servings of fruit consumed on 3 days of dietary recalls ( $r = .23$ ,  $p \leq .05$ ).<sup>11</sup> In general, however, there is relatively little evidence for the relationship of specific practices to dietary outcomes with low-income populations. The analyses of the studies that follow are intended to help address these gaps.

## METHODS

To investigate the possible contribution of food shopping practices to dietary quality, the authors of this report analyzed self-report food shopping practice checklist data from two studies with low-income populations: (1) the 1996 National Food Stamp Program Survey (NFSPS)<sup>9,10</sup> and (2) 1998–99 data from the Expanded Food and Nutrition Education Program (EFNEP) Evaluation/Reporting System (ERS).<sup>12</sup>

**Analysis of NFSPS data.** The 1996 NFSPS gathered data on food shopping practices from a stratified random national sample of 2142 FSP participants.<sup>9,10</sup> Analyses of the relationship between food shopping practices and diet were conducted with a randomly selected subsample of 957 food stamp households that completed a 7-day food use record.<sup>10†</sup> A week before completing the 7-day food use record, survey staff met with the respondent to explain the record-keeping task, working through examples of a grid for recording foods used each day and providing a plastic envelope in which to keep grocery receipts and food labels. As soon as possible following the 7-day period, usually within 24 hours, an interview was conducted to review the food use record. The interview employed a detailed-assisted recall process that was structured according to major food categories. The interview was usually done in the respondent's kitchen to allow the respondent to refer to packages and containers when supplying information. These food use data included all food prepared for use at home including food taken from home supplies but not actually eaten, such as waste in cooking and plate waste. Hence, the 7-day food record in the NFSPS measures food disappearance rather than food consumption.

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<sup>†</sup>A comparison found no significant ( $p \leq .05$ ) differences in the household size, in household income,<sup>10</sup> or in the frequency of engaging in specific food shopping practices between the 957 respondents in the subsample who completed the 7-day food use record and the full sample of 2142 FSP participants.

Accordingly, the term “food availability,” rather than “food intake,” is used to refer to this measure.

The primary dependent variable in these analyses was the percentage of households whose nutritional availability fell above or below the threshold of 100% Recommended Dietary Allowance (RDA) for nutrient intake. The Food Intake Analysis System, developed by the University of Texas at Houston, was used to convert food availability data to nutrient availability data.<sup>10</sup> The study estimated whether the nutrient availability of a household during the observation week met the 100% RDA levels during the observation week for eight different nutrients: vitamin B<sub>6</sub>, folate, protein, vitamin A, vitamin C, calcium, iron, and zinc.<sup>10</sup>

The nutrient availability measure used in the analysis adjusted for household size and household composition as well as meals eaten outside the home. This was done by computing equivalent nutritional units (ENUs) to normalize the household size for the nutritional requirements of household members. The ENU measure scaled the energy requirements (based on the RDAs) of each family member in relation to the food energy requirements of a 30-year-old adult male (adult-male equivalents). For instance, a 30-year-old male has a food energy RDA of 2900 kcal per day, whereas a 30-year-old woman has an RDA of 2200 kcal. Therefore, a married couple in their thirties with no children would have an adjusted household size of 1.76. The measure also adjusted for nutrition requirements based on the age and gender of household members (e.g., women have a higher RDA for calcium, relative to food energy, than men).

The nutrient availability measure was also adjusted for the proportion of meals eaten by each member at home. For example, if half of the meals of a household member were eaten at home, then in computing ENUs, that member's contribution would count only half as much to ENU household size as it would if all of the meals had been eaten at home. (In practical terms, however, this adjustment was modest; in the NFSPS, 85% of meals were eaten at home.)

The use of these ENU adjustments therefore contributes to a more accurate estimate of the relationship between food shopping practices and food availability because the adjustment helps to control for differences in household size, household composition (and resulting differences in RDAs by age and gender), and the proportion of meals eaten in the home.

The independent variable in these analyses was a food shopping practice checklist about the frequency (i.e., “never,” “only,” “occasionally,” “fairly often,” or “pretty much every time”) with which the primary shopper in the household used six commonly encouraged food shopping practices: (1) look for grocery specials, (2) use a shopping list, (3) stock up on bargains, (4) comparison shop, (5) use coupons, and (6) shop in different stores for specials. For simplicity, this article refers to these practices as “careful food shopping practices.” Although these careful food shopping practices have not acquired “recommended” status, they are frequently covered in nutrition education classes with low-income audi-

ences.<sup>13,14</sup> In addition to looking at these individual shopping practices, the analysis created an index of the frequency with which respondents engaged “pretty much every time” in more than one of these practices. For this analysis, we classified the sample into two groups: those participants who reported engaging in three to six careful food shopping practices “pretty much every time” (48.4%) and those participants who reported engaging in fewer than three careful shopping practices “pretty much every time” (51.6%).

Survey data analysis (SUDAAN) software<sup>15</sup> was used to calculate the weights, estimate the variances associated with the survey sampling design, and apply the correct variances in survey analyses. Analyses described the frequency with which FSP participants participated in various food shopping practices and the Pearson correlation among items. A Cochran-Mantel-Haenszel chi-square test, which accounts for the survey design effects,<sup>16</sup> was used to determine if the food shopping practices of the primary shopper were significantly ( $p \leq .05$ ) associated with whether a household met 100% of the RDA level for the specified nutrient. For each dependent variable, multiple logistic regression was used to estimate an odds ratio for the degree of engagement in careful shopping practices, adjusting for household size and poverty status.

The primary statistic used in our regression model to estimate the strength of association between meeting 100% of the RDA and the degree to which households engage in careful food shopping practices was the odds ratio. This ratio reflects the probability of a household meeting 100% of the RDA given a high degree of engagement (three to six) in careful shopping practices compared with the probability of a household meeting 100% of the RDA given a low degree of engagement (zero to two) in careful shopping practices. When there is no difference in the probabilities of meeting 100% of the RDA levels between the two levels of engagement in careful shopping practices, the odds ratio equals 1.0. Therefore, a 95% confidence interval (CI) that contains 1.0 suggests that the differences are not statistically significant at the  $p \leq .05$  level. For example, a CI of 1.34 to 2.47 would indicate statistical significance, whereas a CI of 0.87 to 1.22 would not because this spread includes 1.0.

**Analysis of EFNEP data.** The EFNEP ERS Food Behavior Checklist comprises 10 questions designed to evaluate aspects of food resource management, food safety, and nutrition practices.<sup>12</sup> Each question is answered using a 1- to 5-point scale, where 1 is “do not do,” 2 is “seldom,” 3 is “sometimes,” 4 is “most of the time,” and 5 is “almost always.” Most programs administer the Food Behavior Checklist when participants enrol and again when they graduate (a pre/post model). This study focused on six items of the Food Behavior Checklist related to food shopping practices and food resource management: “How often do you... (1) think about healthy food choices, (2) plan meals ahead, (3) shop with a grocery list, (4) compare prices before buying food, (5) use

Nutrition Facts on the food label to make food choices, and (6) run out of food before the end of the month?"<sup>‡</sup>

Fiscal year 1999 data from individuals were contributed by counties in four states, each of which was recommended by USDA program staff because of their geographic diversity and the completeness of their data: Virginia (47 counties), Colorado (7 counties), Oklahoma (7 counties), and South Dakota (7 counties). The 5159 nonpregnant and nonlactating adolescents and women between the ages of 12 and 50 in these files were selected for these analyses. Ten percent of these women were aged 12 to 20, and 19% were aged 40 or older. Most of these women (79%) lived with children, and 20% of these women had families of five or more. Two-thirds of the sample had a household income of less than \$500 per month (excluding the value of food stamps).<sup>§</sup>

The 24-hour recall data were analyzed using the EFNEP ERS, version 4,<sup>12</sup> which provided information about nutrients (grams of fat, protein, and fiber) and consumption levels of vitamin A, vitamin C, vitamin B<sub>6</sub>, calcium, and iron. Although both baseline and exit data were provided by these

four states, this analysis focused on the baseline data because baseline data are unlikely to be influenced by the EFNEP intervention. Analyses using SAS software (version 6.12)<sup>17</sup> looked at the Pearson correlation among items and used cross-tabulations and a chi-square test at the bivariate relationships between the food behavior checklist items and consumption of RDAs for specific nutrients.

## RESULTS

**Findings from the NFSPS.** Analysis of 2142 respondents in the 1996 NFSPS provides a description of the shopping practices of food stamp households<sup>10</sup> (Table 1). In about half of the food stamp households, the principal shopper reported "pretty much every time" looking for grocery specials (51%) or using a shopping list (50%). Somewhat fewer than half reported that they "pretty much every time" stocked up on bargains (42%), engaged in comparison shopping (41%), or used coupons (41%). Only 18% "pretty much every time" shopped in different stores for specials. Food stamp households above and below 75% of the poverty level reported similar practices, except that households below 75% of the poverty level were significantly ( $p \leq .05$ ) less likely to report "pretty much every time" using a shopping list (47% vs. 56%). In all instances, a significantly ( $p \leq .05$ ) higher proportion of food stamp households engaged in careful shopping practices than a national sample of all households based on a 1998 Food Marketing Institute survey<sup>18</sup> (see Table 1). For instance, 51% of FSP participants but only 31% of all U.S. households looked for grocery specials "pretty much every time."

<sup>‡</sup>The ERS Food Behavior Checklist also includes two additional items on nutritional practices, "How often do... (7) you prepare foods without adding salt, (8) children eat within 2 hours of waking up?" and two items on food safety, "How often do you... (1) let foods sit out for more than 2 hours and (2) thaw frozen foods at room temperature?" These four items showed weaker correlations to the other six questions and are not discussed here because they are not directly relevant to the topic of food shopping. In addition, the ERS contains a pool of optional questions from which states may choose.

<sup>§</sup>EFNEP is allowed to serve low-income families who do not receive food stamps. Although data files did not indicate food stamp participation, state EFNEP coordinators indicated that nearly all of these women received food stamps.

**Table 1.** Food shopping practices of Food Stamp Program participants (%).<sup>a</sup>

<i>Food Shopping Practice</i>	<i>Total Food Stamp Participants (n = 2142)</i>	<i>Below 75% of Poverty (n = 1270)</i>	<i>Above 75% of Poverty (n = 777)</i>	<i>All U.S. Households (N = 1000)</i>
Look for grocery specials	51.4	51.7	51.1	31
Use a shopping list	50.1	47.2 <sup>b</sup>	55.6	NM
Stock up on bargains	42.3	44.1	39.2	24
Comparison shop	41.1	42.3	39.5	19
Use coupons	40.5	40.0	41.9	23
Shop in different stores for specials	17.6	19.7	14.3	6

<sup>a</sup>The table shows the proportion of respondents who reported using these food shopping practices "pretty much every time." Total sample size for Food Stamp Program participants is somewhat larger than for participants broken out by income because not all respondents provided complete income information.

<sup>b</sup>Difference between income groups statistically significant using a chi-square test at  $p < .05$ .

NM = not measured.

Sources: Research Triangle Institute analysis of the 1996 National Food Stamp Program Survey. All U.S. Households: Food Marketing Institute (Trends in the United States: consumer attitudes and the supermarket, 1998, Table 30).<sup>18</sup>

**Table 2.** Pearson correlation coefficient matrix for careful food shopping practices among Food Stamp Program participants.<sup>a</sup>

<i>Food Shopping Practice</i>	1 <i>Look for Grocery Specials</i>	2 <i>Use a Shopping List</i>	3 <i>Stock Up on Bargains</i>	4 <i>Comparison Shop</i>	5 <i>Use Coupons</i>	6 <i>Shop in Different Stores</i>
Look for grocery specials	1.000					
Use a shopping list	.280*	1.000				
Stock up on bargains	.289*	.167*	1.000			
Comparison shop	.384**	.148*	.353**	1.000		
Use coupons	.595***	.273***	.298**	.308**	1.000	
Shop in different stores for specials	.323*	.144*	.315**	.540***	.290***	1.000

\* $p \leq .05$ ; \*\* $p \leq .01$ ; \*\*\* $p \leq .001$ .<sup>a</sup> $n = 953$  Food Stamp Program participants.

Source: RTI analysis of the 1996 National Food Stamp Program Survey.

The Pearson correlations among these food shopping practices are shown in Table 2. Although all of these relationships were statistically significant ( $p \leq .05$ ), the strongest correlations were between “looking in the store for specials” and “using coupons” ( $r = .59, p \leq .001$ ) and between “comparison shopping” and “going to different stores for specials” ( $r = .54, p \leq .001$ ).

Bivariate analyses found significant ( $p \leq .05$ ) relationships between engaging in specific shopping practices and the availability of 100% RDAs in the household, where nutritional availability refers to the nutritional availability at the household level at or above the 100% RDA (Table 3). Food stamp households in which the primary shopper “pretty much every time”

looked for grocery specials were significantly more likely than other food stamp households to meet 100% RDAs for vitamin B<sub>6</sub> ( $p \leq .05$ ), folate ( $p \leq .05$ ), vitamin A ( $p \leq .05$ ), vitamin C ( $p \leq .05$ ), iron ( $p \leq .05$ ), and zinc ( $p \leq .05$ ). Likewise, food stamp households were significantly ( $p \leq .05$ ) more likely to meet 100% of the RDAs if the primary shopper “pretty much every time” used coupons, used a shopping list, or engaged in comparison shopping (see Table 3). No statistically significant ( $p < .05$ ) associations were observed for stocking up on bargains or for going to different stores for specials.

Next, the analysis investigated whether a combination of careful shopping practices, rather than any specified shopping practice, was associated with household nutrient availability.

**Table 3.** Relationship between engaging in careful food shopping practices “pretty much every time” and meeting 100% recommended dietary allowance (RDA) for households participating in the Food Stamp Program.

<i>RDA</i>	<i>Look for Grocery Specials (n = 953)</i>		<i>Use “Cents Off” Coupons (n = 955)</i>		<i>Stock Up on Bargains (n = 955)</i>		<i>Comparison Shop at Different Supermarkets (n = 953)</i>		<i>Go to Different Stores for Specials (n = 955)</i>		<i>Use a Shopping List (n = 957)</i>	
	No <sup>a</sup>	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Vitamin B <sub>6</sub>	59.4 <sup>a</sup>	70.9**	60.5	72.1*	62.9	68.4	62.2	69.9*	64.0	70.9	61.9	68.9
Folate	76.0	82.2*	75.5	84.4**	77.6	81.0	78.0	80.9	79.0	80.0	75.6	82.9*
Protein	87.3	91.5	87.4	92.5	87.6	91.8	87.6	91.9	88.9	91.9	86.9	92.2*
Vitamin A	60.7	68.4*	61.9	68.7*	64.9	64.5	62.1	68.7	65.0	63.2	63.2	66.4
Vitamin C	75.3	82.8*	76.7	82.5	77.9	80.7	78.6	80.1	78.8	80.2	77.0	81.4
Calcium	44.4	50.6	44.0	52.4*	50.1	44.8	48.0	47.0	47.5	47.1	45.4	49.9
Iron	65.4	72.6*	66.4	72.9	69.3	69.1	68.5	69.9	68.5	71.9	66.6	71.9
Zinc	44.1	53.4*	44.8	54.5*	48.1	49.9	46.0	53.0*	48.0	52.7	46.0	52.0*
All participants (48.2)	(51.8)	(58.9)	(41.1)	(54.0)	(46.0)	(59.0)	(41.0)	(81.7)	(18.3)	(52.3)	(47.7)	

<sup>a</sup>Percentage of households that reported engaging or not engaging in the specified food shopping practice “pretty much every time” who met 100% RDA.\*Cochran-Mantel-Haenszel chi-square  $p < .05$ ; \*\*Cochran-Mantel-Haenszel chi-square  $p < .01$ .

Source: RTI analysis of the 1996 National Food Stamp Program Survey.

The analyses compared the likelihood of meeting 100% of the RDA for the nutrients among food stamp households in which the primary shopper reported engaging in three or more careful shopping practices “pretty much every time” to households in which the primary shopper reported engaging in less than three careful shopping practices. Approximately half of the households (52%) were below this level, and half (48%) were above this level. The results indicate that engaging in these careful shopping practices was associated with the availability of 100% of the RDA in the household. Food stamp households in which the primary food shopper engaged in three or more careful shopping practices “pretty much every time” were significantly more likely than households where the food shopper engaged in careful shopping practices less frequently to have met each of the eight different RDAs (Table 4). These findings were strongest for vitamin B<sub>6</sub> (72% vs. 59%,  $p \leq .001$ ).

A multiple logistic regression model that adjusted for household size and household income found that households that “pretty much every time” engaged in three or more careful shopping practices were 1.82 times more likely to have met the RDAs for vitamin B<sub>6</sub> (see Table 4) than households that used careful shopping practices less often. Significant ( $p \leq .05$ ) odds ratios on these models ranged from a low of 1.38 times for calcium and vitamin A to a high of 1.82 times for vitamin B<sub>6</sub>. These analyses indicate that engagement in careful shop-

ping practices was associated with nutrient availability among these food stamp households.

**Findings from the Food Behavior Checklist in the EFNEP ERS.** The proportion of EFNEP participants at the baseline interview who indicated that they almost always engaged in careful shopping-related behaviors ranged from 8% for using nutrition labels to 41% for comparison shopping (Table 5). One-quarter of participants reported that they almost always shopped with a grocery list (25%). A minority of participants almost always thought about health food choices (18%) and planned meals ahead (12%). Only 25% of the participants reported that they never ran out of food by the end of the month.

Although Pearson correlations among all of these items were significant (Table 6), the correlations among the food shopping-related items (planning meals ahead, comparing prices, shopping with a grocery list, and reading food labels) were appreciably higher than the correlations with the item “running out of food before the end of the month.” This suggests that running out of food by the end of the month may reflect an aspect of food resource management that is distinct from shopping practices.

Women who reported that they almost always “think about healthy food choices” were significantly more likely than other women to meet 100% of the RDA for vitamin C

**Table 4.** Relationship between degree of engagement in careful food shopping practices and achievement of 100% RDA availability of selected nutrients in the households of Food Stamp Program participants ( $n = 947$ ).<sup>a</sup>

<i>RDA</i>	<i>0–2 Shopping Practices</i>	<i>3–6 Shopping Practices</i>	<i>Cochran-Mantel-Haenszel Chi-square (p Value)</i>		<i>Odds Ratio (95% CI) (Covariates: Income, Household Size)</i>	
Vitamin B <sub>6</sub>	58.9	72.5	15.6	(<.001)	1.82 <sup>a</sup>	(1.34–2.47) <sup>b</sup>
Folate	75.4	83.6	8.9	(.005)	1.62	(1.16–2.27)
Protein	86.6	92.7	4.0	(.052)	1.94	(0.97–3.85)*
Vitamin A	61.0	68.6	5.6	(.023)	1.38	(1.03–1.86)
Vitamin C	76.1	82.9	7.2	(.011)	1.45	(1.05–2.00)
Calcium	44.6	50.8	4.5	(.042)	1.38	(1.05–1.81)
Iron	65.1	73.4	9.4	(.004)	1.51	(1.15–1.99)
Zinc	44.3	53.8	8.2	(.007)	1.52	(1.16–2.00)
All participants	(51.6)	(48.4)				

<sup>a</sup>This table compares the nutrient availability in food stamp households where the primary shopper did not or did “pretty much every time” engage in three or more careful food shopping practices. Data came from a stratified random national sample of 947 food stamp participants who completed 7-day dietary records in the 1996 National Food Stamp Program Survey.

<sup>b</sup>Odds ratio adjusted for household size and 75% poverty status ( $n = 912$ ).

<sup>c</sup>95% confidence interval. In the case of vitamin B<sub>6</sub>, the odds ratio is 1.82 and the 95% confidence interval for the estimate of the odds ratio extends from a lower bound of 1.34 to an upper bound of 2.47. Any odds ratio for which the lower bound of the confidence interval extends below 1.0 is not statistically significant.

\*Not statistically significant.

Source: RTI analysis of the 1996 National Food Stamp Program Survey.

RDA = Recommended Dietary Allowance.

**Table 5.** Percentage of EFNEP participants who reported engaging in various food shopping behaviors at baseline.<sup>a</sup>

<i>Food Shopping Behavior</i>	<i>N</i>	<i>Do Not Do</i>	<i>Seldom</i>	<i>Sometimes</i>	<i>Most of the Time</i>	<i>Almost Always</i>
Think about healthy food choices	5144	8.4	11.5	31.0	31.2	17.8
Plan meals ahead	5157	15.4	15.0	33.0	24.9	11.6
Shop with a grocery list	5144	21.0	12.6	22.7	19.0	24.7
Compare prices before buying food	5159	7.5	7.0	17.8	26.9	40.9
Use the Nutrition Facts panel on the food label to make food choices	5120	31.6	22.9	26.4	11.2	7.9
Run out of food before the end of the month	5139	24.9	23.2	28.9	13.0	10.1

<sup>a</sup>This table presents data on the food shopping behavior of nonpregnant, nonlactating adolescents and women aged 12–50 participating in the Expanded Food and Nutrition Education Program (EFNEP) in selected counties from four states.

(54% vs. 48%,  $p \leq .01$ ), vitamin A ( $p \leq .01$ ), vitamin B<sub>6</sub> ( $p \leq .01$ ), and iron ( $p \leq .05$ ) (Table 7). Women who reported that they almost always planned meals ahead were significantly more likely than other women to meet the RDA for vitamin A (35% vs. 31%,  $p \leq .01$ ).

In addition, women who said that they almost always used Nutrition Facts on food labels to make food choices had significantly ( $p \leq .01$ ) lower consumption of fat (grams) than did those who did not use or only seldomly used Nutrition Facts (Table 8). In contrast, using Nutrition Facts was not significantly ( $p \leq .05$ ) associated with fiber consumption.

## DISCUSSION

The results from this study support findings from Murphy et al.<sup>11</sup> Food shopping practices can influence nutrient intake in

low-income households and are therefore key topics to be covered in nutrition education.

This study has several limitations. It did not establish the reliability or validity of measures of food shopping practices. Reliability can be assessed by comparing how consistently people report their food shopping practices if they are asked the same questions more than once.<sup>19</sup> Assessment of validity, the extent to which a test measures what it claims to measure, requires independent verification of actual behavior (e.g., food shopping practices).<sup>19</sup> Such validation has not been conducted with these self-reported food shopping behavior checklists. However, these analyses offer support for the validity of the food shopping measures by demonstrating that a relationship does exist between self-report measures of food shopping practices and dietary quality.

There are also limitations in the dependent measures of these studies. The 7-day food record has been used in national

**Table 6.** Pearson correlation coefficient matrix for food shopping behaviors among EFNEP participants.<sup>a</sup>

<i>Food Shopping Behavior</i>	<i>1</i> <i>Think about</i> <i>Healthy Choices</i>	<i>2</i> <i>Plan</i>	<i>3</i> <i>Shop with</i> <i>Grocery List</i>	<i>4</i> <i>Compare</i>	<i>5</i> <i>Use</i> <i>Labels</i>	<i>6</i> <i>Run Out</i> <i>of Food</i>
Think about healthy food choices	1.000					
Plan meals ahead	.318***	1.000				
Shop with a grocery list	.271***	.302**	1.000			
Compare prices before buying food	.297***	.318***	.306***	1.000		
Use Nutrition Facts on the food label to make choices	.359***	.215***	.222***	.236***	1.000	
Run out of food before the end of the month	.049*	.035***	.037*	-.042*	.050**	1.000

<sup>a</sup>n = 5139 nonpregnant, nonlactating adolescents and women aged 12–50 participating in the Expanded Food and Nutrition Education Program (EFNEP) in selected counties from four states at baseline.

\* $p \leq .05$ ; \*\* $p \leq .01$ ; \*\*\* $p \leq .001$ .

**Table 7.** Percentage of EFNEP participants who engaged in specific food shopping behaviors related to 100% RDA consumption of specific nutrients.<sup>a</sup>

<i>Nutrient</i>	<i>Think about Healthy Food Choices</i> ( <i>n</i> = 5144)		<i>Plan Meals Ahead</i> ( <i>n</i> = 5157)		<i>Shop with a Grocery List</i> ( <i>n</i> = 5144)		<i>Compare Prices Before Buying Food</i> ( <i>n</i> = 5159)		<i>Use Nutrition Facts on the Food Label to Make Food Choices</i> ( <i>n</i> = 5120)		<i>Run Out of Food Before the End of the Month</i> ( <i>n</i> = 5139)	
	Less Often	Almost Always	Less Often	Almost Always	Less Often	Almost Always	Less Often	Almost Always	Less Often	Almost Always	Never	More Often
Vitamin B <sub>6</sub>	18.5	22.1**	19.3	18.4	19.1	19.4	18.7	19.8	19.0	20.9	21.2	18.4*
Protein	65.7	69.1*	65.9	68.3	65.9	66.8	66.3	66.0	66.4	63.0	68.0	65.5
Vitamin A	30.6	35.1**	30.9	35.1*	30.9	32.9	31.3	31.4	31.5	31.3	33.3	30.7
Vitamin C	47.6	53.8**	48.3	51.7	48.7	48.4	48.8	48.5	48.4	53.0	52.5	47.3**
Calcium	30.5	32.6	30.8	30.7	30.3	32.2	30.8	30.7	30.9	30.5	31.6	30.4
Iron	15.2	18.0*	15.5	17.2	15.5	16.0	15.7	15.6	15.4	17.0	16.4	15.3
All participants	(82.2)	(17.8)	(88.6)	(11.4)	(75.9)	(24.1)	(60.0)	(40.0)	(92.3)	(7.7)	(24.9)	(75.1)

<sup>a</sup>This table shows the percentage of women who "almost always" engaged in a specified food shopping behavior and met 100% Recommended Dietary Allowance (RDA). It also shows the percentage of women who met the 100% RDA if they engaged in this food shopping practice "less often" (i.e., one of the four response categories other than "almost always").

\*Cochran-Mantel-Haenszel chi-square  $p < .05$ ; \*\*Cochran-Mantel-Haenszel chi-square  $p < .01$ .

Source: RTI analysis of the 1999 baseline Expanded Food and Nutrition Education Program (EFNEP) data selected from counties in four states.

studies to calculate food availability,<sup>20</sup> and the estimates of household food availability in the NFSPS are very similar to estimates for low-income households on the CSFII.<sup>10</sup> Nonetheless, because it includes cooking and plate waste and relies on statistical adjustments for differences in household size and composition, a measure of nutrient availability at the household level is not necessarily as clear an indicator of diet as are individual intake measures.

Conversely, although the EFNEP study provides data on individual intake, a single day of 24-hour recall does not usually provide the same degree of reliability as multiple days of 24-hour recall data,<sup>19</sup> although data on a single 24-hour recall have been found to be associated ( $p \leq .05$ ) with biochemical measures of nutrients in an EFNEP population.<sup>11</sup>

The biggest limitation is that this analysis does not prove that careful food shopping practices result in improved diet.

**Table 8.** Relationship between frequency of using Nutrition Facts panel of the food label and mean consumption of fat and fiber at baseline among EFNEP participants.<sup>a</sup>

<i>Outcome</i>	<i>Frequency of Reading Food Labels</i>			<i>Most of the Time</i>	<i>Almost Always</i>
	<i>Do Not Do</i>	<i>Seldom</i>	<i>Sometimes</i>		
Fat (g)					
N	1616	1173	1354	571	406
Mean	73.3 <sup>b</sup>	72.8 <sup>b</sup>	71.5 <sup>c</sup>	67.6	64.8 <sup>d</sup>
SD	57.2	46.8	60.3	49.7	41.9
Fiber (g)					
N	1616	1173	1354	571	406
Mean	12.3	12.6	12.5	12.2	12.8
SD	10.2	11.1	10.3	10.3	10.5

<sup>a</sup>This table shows the mean grams of fat and fiber consumed by respondents who reported different frequencies of using Nutrition Facts on the food label to make food choices. Respondents were nonpregnant, nonlactating adolescents and women 12–50 years old participating in the Expanded Food and Nutrition Education Program (EFNEP) in selected counties of four states at baseline.

<sup>b</sup>b vs. d:  $p < .01$  using a t-test (two-tailed); <sup>c</sup>c vs. d:  $p < .05$  using a t-test (two-tailed).

Correlation does not establish causality, and it is possible that women in households with diets that met RDAs share other, unmeasured, characteristics that might have resulted in improved shopping. Although the analyses in this study controlled for household size, household income, and household composition, this analysis could not control for all potential confounding factors. Nonetheless, the fact of a significant association—in two different studies—suggests that the relationship between food shopping practices is important to investigate. More carefully controlled intervention studies are needed to establish the direction of relationships.

The two sets of analyses complement each other. The NFSPS provides household-level, rather than individual-level, nutritional data, but these data were based on a week's food use in a nationally representative sample. The EFNEP study relies on a single 24-hour recall, but data describe the intakes of individuals rather than households. Both studies relied on cross-sectional data, so it is possible that other factors may have influenced study findings. Nonetheless, the findings suggest that food shopping practices are associated with nutrient availability and are therefore important to assess.

Because these data were collected while the nutrient standards were the RDAs,<sup>21</sup> analyses used those standards for comparisons. However, the dietary reference intakes (DRIs) gradually have been replacing the RDAs for most nutrients.<sup>22–25</sup> With regard to the nutrients used for analyses with food shopping behaviors in this article, recommendations for folate,<sup>23</sup> vitamin C,<sup>24</sup> and iron<sup>25</sup> have increased, whereas recommendations for vitamin B<sub>6</sub>,<sup>23</sup> vitamin A,<sup>25</sup> and zinc<sup>25</sup> have decreased. The RDA for calcium was changed from 1200 mg/day for 19- to 24-year-old females and 800 mg/day for 25- to 50-year-old females to an adequate intake (AI) recommendation of 1000 mg/day for females aged 19 to 50.<sup>22</sup> Future studies need to examine food shopping behaviors with relation to these newer standards. Still, these differences in nutrient standards are unlikely to affect the major finding of this study—namely, the relationship between shopping practices and either nutrient availability or nutrient intake.

The findings appear to be fairly robust. This article focuses on the 100% RDA level because that result is easier to interpret. However, analysis found similar relationships between food shopping practices and availability (in NFSPS) or consumption (in the EFNEP) of 75% of the RDA. The analysis of the number of careful food shopping practices found stronger bivariate relationships when we chose three or more careful food shopping practices as a cutpoint rather than an alternative (e.g., four or more). But this choice did not appear to be associated with any unusual pattern in the data; rather, we selected three or more because it was close to the median of the sample (52% were lower than this value and 48% were higher), and equal sample sizes typically result in somewhat greater statistical power than the more uneven sample sizes that would have resulted from an alternative cutpoint. Nonetheless, questions about the number and combination of food shop-

ping practices associated with dietary quality in low-income families deserve further study.

Both studies analyzed in this article indicate that careful food shopping practices (Table 9) were reported by a substantial proportion of low-income households. For instance, 41% of FSP participants and 41% of EFNEP participants, at baseline, engaged in comparison shopping “pretty much every time” (NFSPS) or “almost always” (EFNEP). About half of FSP participants in the NFSPS reported that they “pretty much every time” looked for specials (51%) or used a shopping list (50%), stocked up on bargains (42%), or used coupons (41%). This suggests that many careful food shopping practices can be employed by low-income populations. On the other hand, less than one-fifth of FSP participants shopped in different supermarkets for specials (18%), so this may not be practical for many low-income families.

Clearly, many of the food shopping skills taught in nutrition education programs (e.g., comparison shopping) make intuitive sense. The two studies analyzed in this article (one with participants in the EFNEP and another with a national sample of FSP participants) both demonstrated statistically significant ( $p < .05$ ) relationships between careful food shopping practices and nutrient availability (see Table 9).

One possibility is that these relationships are associated less with any particular shopping practice than with a combination of food shopping practices. For instance, Campbell and Desjardins<sup>2</sup> suggested that households use multiple approaches to take maximum advantage of their resources.<sup>5</sup> This is consistent with the finding in this study that engagement in three or more careful shopping practices was significantly associated with nutrient availability. Interestingly, analysis of the EFNEP ERS data found that the strongest association of any single food shopping practice with diet quality was “thinking about healthy food choices.” Hence, the effects of a more general awareness of nutrition that might influence a variety of food shopping practices may be useful to explore further.

## IMPLICATIONS FOR RESEARCH AND PRACTICE

The overall conclusion of this study is that the food shopping practices of low-income families are associated with diet quality; as such, this is an area that deserves increased attention in nutrition education and evaluation efforts. There is a need for research to assess the reliability of these measures and the validity with which the self-report measures from low-income respondents reflect actual food shopping practices. This study also points to the value of additional research about the types of food shopping practices that contribute to the diet of low-income families. Although the results from this study suggest that shopping practices can play a role in improving diet, more study is needed to learn what types of skills are most useful to different people given their particular circumstances.

**Table 9.** Frequency (%) of using recommended food shopping practices and its relationship to dietary quality among Food Stamp Program and EFNEP participants.

<i>Food Shopping Practice</i>	<i>FSP</i> <i>"Pretty Much Every Time"</i> <i>(n = 2142)</i>	<i>EFNEP</i> <i>"Almost Always"</i> <i>(n = 5159)</i>	<i>Relationship to Dietary Quality</i>
Look for grocery specials	51.4	NM	Logistic regression model with FSP participants (controlling for age, income, and household size) found that "pretty much every time" engaging in 3 or more careful shopping practices was significantly associated with 100% RDA nutrient availability for vitamins B <sub>6</sub> , A, and C; folates; calcium; iron; and zinc
Use a shopping list (shop with a grocery list)	50.1	24.7	
Stock up on bargains	42.3	NM	
Comparison shop (compare prices before buying)	41.1	40.9	
Use coupons	40.5	NM	
Shop in different stores for specials	17.6	NM	
Use Nutrition Facts panel on the food label to make food choices	NM	7.9	Related to lower fat consumption as determined by 24-hour recall among EFNEP participants
Think about healthy food choices	NM	17.8	Related to RDAs (vitamins A, C, and B <sub>6</sub> ; protein; and iron) in 24-hour recall in EFNEP participants
Plan meals ahead	NM	11.6	Related to RDA for vitamin A in 24-hour recall in EFNEP participants
Run out of food before the end of month	NM	10.1	Related to RDAs for vitamins C and B <sub>6</sub> in 24-hour recall in EFNEP participants

FSP = Food Stamp Program; EFNEP = Expanded Food and Nutrition Education Program; NM = not measured; RDA = Recommended Dietary Allowance.

This study did not assess the extent to which nutrition education affects food shopping practices. This remains an important area for investigation, and there will be considerable value in research and sharing of ideas about strategies that improve food shopping practices with low-income families.

In conclusion, this study does not prove that food shopping practices result in improved nutrition among low-income families. Nonetheless, the association between food shopping practices and increased nutrient availability and/or intake that achieves 100% of the RDA levels suggests that this will be an important area for research and practice.

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